(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: 0 069 531 B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: 26.02.86

(51) Int. Cl.4: F 04 C 18/02

(21) Application number: 82303420.2

(22) Date of filing: 29.06.82

(54) A scroll type compressor having an improved fluid discharge mechanism.

(30) Priority: 29.06.81 JP 101711/81

(43) Date of publication of application: 12.01.83 Bulletin 83/02

(45) Publication of the grant of the patent: 26.02.86 Bulletin 86/09

(84) Designated Contracting States: DE FR GB IT SE

(56) References cited:
EP-A-0 012 614
DE-A-2 160 582
US-A-3 473 728

(73) Proprietor: SANDEN CORPORATION
20 Kotobuki-cho
Isesaki-shi Gunma-ken (JP)

(72) Inventor: Hiraga, Masaharu
8-34, Honjo 4-chome
Honjo-shi Saitama-ken (JP)
Inventor: Kawano, Akihiro
6-18, Minami-cho 3-chome
Maebashi-shi Gunma-ken (JP)

(74) Representative: Pritchard, Colin Hubert et al
Mathys & Squire 10 Fleet Street
London EC4Y 1AY (GB)

EP 0 069 531 B1

Courier Press, Leamington Spa, England.

Description

This invention relates to a fluid displacement apparatus, and more particularly, to a scroll type compressor having an improved fluid discharge mechanism.

Scroll type fluid displacement apparatus are well known in the prior art. For example, U.S. Patent No. 801.182 (Creux) discloses a scroll type apparatus including two scroll members each having a circular end plate and a spiroidal or involute spiral element. These scroll members are maintained angularly and radially offset so that both spiral elements interfit to make a plurality of line contacts between their spiral curved surfaces to thereby seal off and define at least one pair of fluid pockets. The relative orbital motion of the two scroll members shifts the line contacts along the spiral curved surfaces and, therefore, the fluid pockets change in volume. Since the volume of the fluid pockets increases or decreases dependent on the direction of orbital motion, the scroll type fluid displacement apparatus is applicable to compress, expand or pump fluids.

In a conventional scroll type compressor, one of the two scroll members is fixedly disposed and the other is driven to make an orbital motion by a driving mechanism, as shown in EP—A—0 012 614. In the compressor, an orbiting spiral element and a fixed spiral element make four line contacts at points A—D. A pair of fluid pockets are defined between line contacts D, C and line contacts A, B. The fluid pockets are defined not only by the walls of the spiral elements, but also by the end plates from which these spiral elements extend. When orbiting spiral element is moved in relation to the fixed spiral element so that the center O′ of the orbiting spiral element revolves around the center O of the fixed spiral element at a radius O—O′, while rotation of orbiting spiral element is simultaneously prevented, fluid pockets shift angularly and radially toward the center of the spiral elements, which decreases the volume of fluid pockets. Therefore, the fluid in each pocket is compressed.

The pair of fluid pockets are interconnected as the spiral elements reach a certain stage in the rotation and subsequently the pockets merge to form a central single pocket which defines the center portion of both spiral elements. The volume of the single pocket is reduced by further revolution of the orbiting spiral element by 90° increments. During the course of revolution, outer spaces which are open at one stage, change to form new sealed off fluid pockets in which additional fluid is enclosed. Accordingly, assuming circular end plates seal the axial facing ends of respective spiral elements and if one of the end plates is provided with discharge port at the center thereof, fluid is taken into the fluid pockets at the radial outer portions and is discharged from discharge port after compression.

A valve member is disposed on the outside of the discharge port to control the closing and opening of discharge port. The valve member includes a valve plate and valve retainer. The valve plate and valve retainer are fixed on the end surface of end plate on the opposite side from which spiral element extends. In this construction, the pressure in the center pocket increases due to the reduction in volume of central pocket during orbital motion of orbiting spiral element. When the pressure in central pocket is higher than the pressure in the discharge chamber, the valve plate is pushed against the valve retainer to open the discharge port. As a result, the compressed fluid within the central pocket discharges into the discharge chamber. Accordingly, the compressed fluid within the central pocket is discharged by revolution of the orbiting spiral element.

When the outer side wall of the inner end portion of the orbiting spiral element crosses over the edge of the discharge port, the central pocket is connected with the adjacent radial pair of fluid pockets. This increases the volume of the central pocket so that the remaining compressed fluid within the central pocket is re-expanded. After re-expansion of the compressed fluid, the pressure in the expanded central pocket is lower than the pressure in discharge chamber to thereby close the discharge port via the valve plate. Upon re-expansion of the compressed fluid in the central pocket, the pressure in the adjacent radial pair of fluid pockets is suddenly raised. Therefore, the compression power of the fluid within the new central pocket is increased and the pressure of the pair of fluid pockets is raised.

It is desirable to reduce the re-expansion volume of a scroll compressor of the type described above in order to improve efficiency. One solution for reducing the re-expansion volume is to change the configuration of the curve of the outer and inner side walls of the spiral elements. In particular, the inner end of the outer side wall can be extended inwardly to the circumference of the generating circle. The outer portion of the inner side wall, which extends from the contact point on the inner side wall where interference of the spiral elements occurs to the terminal end, then forms the involute. The inner end of the outer side wall and the contact point on the inner side wall are connected by a suitable curve which is drawn to avoid actual interference between the spiral elements.

In the above described configuration of the spiral elements, the maximum open area of the discharge port, which still results in a minimized re-expansion volume, is obtained by placing the discharge port near the center of the generating circle and inscribing the discharge port on the outer side wall of the fixed spiral element and the inner side wall of the orbiting spiral element. However, in actual practice, the open area of the discharge port must be made larger than the above described maximum area of the discharge port in order to reduce the pressure loss of passing fluid. Accordingly, since the configuration of discharge port influences the re-expansion volume, in actual practice the above described

compressor does not result in a reduced re-expansion volume without at the same time increasing pressure loss.

DE—A—2 160 582 discloses a scroll-type pump comprising a first scroll having a wrap with a bulbous shaped enlarged portion and a second scroll orbiting relatively to the first scroll. The enlarged inner portion is provided with a valve chamber, a discharge hole and a valve member disposed within the valve chamber. In the arrangement, the re-expansion volume is not so sufficiently reduced and the valve member is complicated in structure.

It is a primary object of this invention to provide a scroll type compressor which has improved power efficiency.

It is another object of this invention to provide a scroll type compressor wherein the re-expansion volume is reduced without raising the pressure loss of the fluid which flows from the central fluid pocket defined by the scrolls to the discharge chamber through the discharge hole. Accordingly, it is an object of this invention to reduce the re-expansion volume without altering the configuration of the discharge port.

It is still another object of this invention to provide a scroll type compressor which has a valve member of a single structure.

According to the present invention there is provided a scroll type compressor including a housing having a fluid inlet port and a fluid outlet port, a fixed scroll joined with said housing and having a first end plate from which a first wrap extends into the interior of said housing, an orbiting scroll having a second end plate from which a second wrap extends, said first and second wraps interfitting at an angular and radial offset to make a plurality of line contacts to define at least one pair of sealed off fluid pockets and a central fluid pocket, a driving mechanism operatively connected to said orbiting scroll to effect the orbital motion of said orbiting scroll, and a rotation preventing means for preventing the rotation of said orbiting scroll so that the volume of the fluid pockets changes during the orbital motion of said orbiting scroll, characterised in that the inner end portion of each of said wraps has a bulbous shaped enlarged portion, a valve chamber is formed in the enlarged portion of said first wrap, a discharge hole is formed through the inner side wall of said enlarged portion at a position near the center of the generating circle of said orbiting scroll to connect the central fluid pocket and said valve chamber, a valve member is disposed within said valve chamber to control the opening and closing of said discharge hole, and said valve member includes an annular shaped valve plate which has a reed valve and a valve retainer disposed within the inner side of said valve plate.

The invention will now be described, by way of example, with reference to the accompanying drawings, in which:—

Figures 1a—1d are schematic views illustrating the conventional relative movement of interfitting spiral elements to compress fluid;

Figure 2 is a partly perspective view of a scroll member illustrating the prior art construction of the center portion of a scroll member;

Figure 3 is a sectional view taken along line III—III in Figure 2;

Figure 4 is a vertical sectional view of a scroll type compressor according to one embodiment of this invention;

Figure 5 is an exploded perspective view of the driving mechanism used in the compressor of Figure 4;

Figure 6 is an exploded perspective view of the rotation preventing/thrust bearing device used in the compressor of Figure 4;

Figures 7a—7d are schematic views illustrating the operation of the scroll type compressor to compress fluid according to one embodiment of this invention;

Figure 8 is a partly exploded perspective view of the center of the fixed scroll of Figure 7;

Figure 9 is a vertical sectional view of a scroll type compressor according to another embodiment of this invention; and

Figure 10 is a partly exploded perspective view of the center of the fixed scroll used in the compressor of Figure 9.

The principle of operation of a conventional scroll type compressor is illustrated in Figures 1a—1d, which show end views of a compressor wherein the end plates are removed to show the spiral elements. Spiral elements 1 and 2 are angularly offset and interfit with one another. As shown in Figure 1a, orbiting spiral element 1 and fixed spiral element 2 make four line contacts at points A—D. A pair of fluid pockets 3a and 3b are defined between line contacts D, C and line contacts A, B as shown by the dotted regions. Fluid pockets 3a and 3b are defined not only by the walls of spiral elements 1 and 2, but also by the end plates from which these spiral elements extend. When orbiting spiral element 1 is moved in relation to fixed spiral element 2 so that the center O′ of orbiting spiral element 1 revolves around the center O of fixed spiral element 2 at radius O—O′, while rotation of orbiting spiral element 1 is simultaneously prevented, fluid pockets 3a and 3b shift angularly and radially toward the center of the spiral elements, which decreases the volume of fluid pockets 3a and 3b. Therefore, the fluid in each pocket is compressed.

The pair of fluid pockets 3a and 3b are interconnected as the spiral elements pass between the stages shown in Figure 1c and Figure 1d. Then, as shown in Figure 1a, both pockets 3a and 3b merge to form a central single pocket 5 which defines the center portion of both spiral elements 1 and 2. The volume of the single pocket is reduced by further revolution of the orbiting spiral element by 90° increments as shown in Figures 1b, 1c and 1d. During the course of revolution, outer spaces which open in the stage shown in Figure 1b change as shown in Figures 1b, 1c and 1d to form new sealed off fluid pockets in which additional fluid is enclosed. Accordingly,

assuming circular end plates seal the axial facing ends of spiral elements 1 and 2, respectively, and if one of the end plates is provided with discharge port 4 at the center thereof as shown in Figure 1, fluid is taken into the fluid pockets at the radial outer portions and is discharged from discharge port 4 after compression.

The actual operation of a scroll type compressor now will be described with reference to Figures 2 and 3. Figure 2 is a perspective view of the center portion of one scroll member and Figure 3 is a sectional view taken along line III—III in Figure 2. As shown in Figure 2, discharge port 4 is formed in end plate 6 and a valve member 7 is disposed on the outside of discharge port 4 to control the closing and opening of discharge port 4. Valve member 7 includes valve plate 71 and valve retainer 72. Valve plate 71 and valve retainer 72 are fixed on the end surface of end plate 6 on the opposite side from which spiral element 2 extends by bolt 73 as shown in Figure 3. In this construction, the pressure in center pocket 5 increases due to the reduction in volume of central pocket 5 during orbital motion of orbiting spiral element 1. When the pressure in central pocket 5 is higher than the pressure in discharge chamber 8, valve plate 71 is pushed against valve retainer 72 to open discharge port 4. As a result, the compressed fluid within central pocket 5 discharges into discharge chamber 8. Accordingly, the compressed fluid within central pocket 5 is discharged by revolution of orbiting spiral element 1.

When the outer side wall of the inner end portion of orbiting spiral element 1 crosses over the edge of discharge port 4, central pocket 5 is connected with the adjacent radial pair of fluid pockets 3a and 3b. This increases the volume of the central pocket so that the remaining compressed fluid within central pocket 5 is re-expanded. After re-expansion of the compressed fluid, the pressure in the expanded central pocket is lower than the pressure in discharge chamber 8 to thereby close discharge port 4 via valve plate 71. Upon re-expansion of the compressed fluid in the central pocket, the pressure in the adjacent radial pair of fluid pockets is suddenly raised. Therefore, the compression power of the fluid within the new central pocket is increased and the pressure of the pair of fluid pockets is raised.

Referring to Figure 4, a scroll type compressor in accordance with the present invention is shown. The compressor includes compressor housing 10 having front end plate 11 and cup shaped casing 12 fastened to an end surface of front end plate 11. An opening 111 is formed in the center of front end plate 11 for supporting drive shaft 13. An annular projection 112, concentric with opening 111, is formed on the rear end surface of front end plate 11 facing cup shaped casing 12. An outer peripheral surface of annular projection 112 bites into an inner wall of the opening of cup shaped casing 12. Cup shaped casing 12 is fixed on the rear end surface of front end plate 11 by a fastening device, such as bolts and nuts, so that the opening of cup shaped casing 12 is covered by front end plate 11. An O-ring 14 is placed between the outer peripheral surface of annular projection 112 and the inner side wall of cup shaped casing 12 to seal the mating surface between front end plate 11 and cup shaped casing 12. Front end plate 11 has annular sleeve 15 projecting from the front end surface thereof; this sleeve 15 surrounds drive shaft 15 to define a shaft seal cavity. Shaft seal assembly 16 is assembled on drive shaft 15 within the shaft seal cavity. As shown in Figure 4, sleeve 15 is attached to the front end surface of front end plate 11 by screws (not shown). An O-ring 17 is placed between the front end surface of front end plate 11 and an end surface of sleeve 15 to seal the mating surface of front end plate 11 and annular sleeve 15. Alternatively, sleeve 15 may be formed integral with front end plate 11.

A pulley 18 is rotatably supported by bearing 19 on the outer surface of sleeve 15. An electromagnetic coil 20, which is received in an annular cavity of pulley 18, is mounted on the outer surface of sleeve 15 by support plate 201. An armature plate 21 is elastically supported on the outer end of drive shaft 13 which extends from sleeve 15. A magnetic clutch is formed by pulley 18, magnetic coil 20 and armature plate 21. Thus, drive shaft 13 is driven by an external power source, for example, an engine of a vehicle, through a rotation transmitting device, such as the above described magnetic clutch.

A number of elements are located within the inner chamber of cup shaped casing 12 including fixed scroll 22, orbiting scroll 23, a driving mechanism for orbiting scroll 22 and rotation preventing/thrust bearing device 24 for orbiting scroll 22. The inner chamber of cup shaped casing 12 is formed between the inner wall of cup shaped casing 12 and the rear end surface of front end plate 11.

Fixed scroll 22 includes circular end plate 221, wrap or spiral element 222 affixed to or extending from one end surface of end plate 221, and a plurality of internal bosses 223 axially projecting from the end surface of end plate 221 on the side opposite spiral element 222. The end surface of each boss 223 is seated on the inner surface of each plate portion 121 of cup shaped casing 12 and is fixed to end plate portion 121 by a plurality of bolts 25, one of which is shown in Figure 4. Hence, fixed scroll 22 is fixedly disposed within cup shaped casing 12. Circular end plate 221 of fixed scroll 22 partitions the inner chamber of cup shaped casing 12 into discharge chamber 26 having bosses 223, and suction chamber 27, in which spiral element 222 of fixed scroll 22 is located. Sealing member 28 is disposed within circumferential groove 224 of circular end plate 221 for sealing the outer peripheral surface of circular end plate 221 and the inner wall of cup shaped casing 12.

Orbiting scroll 23, which is disposed in suction chamber 27, includes circular end plate 231 and wrap or spiral element 232 affixed to or extending

from one end surface of circular end plate 231. The spiral elements 222 and 232 interfit at angles of 180° and a predetermined radial offset. The spiral elements define at least a pair of fluid pockets between their interfitting surfaces. Orbiting scroll 23 is connected to the driving mechanism and rotation preventing/thrust bearing device 24 to effect the orbital motion of orbiting scroll 23 by the rotation of drive shaft 13 to thereby compress fluid passing through the compressor, as described above in connection with Figures 1a—1d.

Referring to Figures 4 and 5, the driving mechanism for orbiting scroll 23 will now be described. As described below, drive shaft 13, which is rotatably supported by sleeve 15 through bearing 29, has a disk shaped rotor 131 at its inner end. Disk shaped rotor 131 is also rotatably supported by front end plate 11 through bearing 30 located within opening 111 of front end plate 11. A crank pin or drive pin 132 projects axially from an axial end surface of disk shaped rotor 131 and is radially offset from the center of drive shaft 13. Circular end plate 231 of orbiting scroll 23 has tubular boss 233 axially projecting from the end surface opposite to the end surface from which spiral element 232 extends. A discoid or short axial bushing 31 fits into boss 233, and is rotatably supported therein by a bearing, such as needle bearing 32. An eccentric hole 33 is formed on bushing 31; eccentric hole 33 is radially offset from the center of bushing 31. Drive pin 132, which is surrounded by bearing 34, fits into eccentric hole 33. Therefore, bushing 31 is driven by the revolution of drive pin 132 to thereby rotate within bearing 32. The spiral element of the orbiting scroll is pushed against the spiral element of the fixed scroll due to the moment created between the driving point and the reaction force acting point of the pressurized gas to secure the line contacts and effect radial sealing.

Referring to Figures 4 and 6, rotation preventing/thrust bearing device 24 will be described. Rotation preventing/thrust bearing device 24 is placed between the inner end surface of front end plate 11 and the end surface of circular end plate 231 which faces the inner end surface of front end plate 11, as shown in Figure 4. Rotation preventing/thrust bearing device 24 includes fixed ring 241 and sliding ring 242. Fixed ring 241 is secured to the inner end surface of annular projection 112 by pins (not shown), and provided with a pair of keyways 241a and 241b in an axial end surface facing orbiting scroll 23. Sliding ring 242 is disposed in a hollow space between fixed ring 241 and circular end plate 231 of orbiting scroll 23, and provided with a pair of keys 242a and 242b on the axial end surface facing fixed ring 241, which are received in keyways 241a and 241b. Therefore, sliding ring 242 is slidable in the radial direction by the guide of keys 242a and 242b within keyways 241a and 241b. Sliding ring 242 is also provided with a pair of keys 242c and 242d on its opposite surface. Keys 242c and 242d are arranged along a diameter perpendicular to the diameter along which keys 242a and 242b are arranged. Circular end plate 231 of orbiting scroll 23 is provided with a pair of keyways (in Figure 6 only one keyway 231a is shown; the other keyway is disposed diametrically opposite to keyway 231a) on a surface facing sliding ring 242 in which are received keys 242c and 242d. Therefore, orbiting scroll 23 is slidable in a radial direction by the guide of keys 242c and 242d within the keyways of circular end plate 242.

Accordingly, orbiting scroll 23 is slidable in one radial direction with sliding ring 242, and is slidable in another radial direction independently. The second radial direction is perpendicular to the first direction. Therefore, orbiting scroll 23 is prevented from rotation, but is permitted to move in two radial directions perpendicular to one another.

In addition, sliding ring 242 is provided with a plurality of pockets or holes 34 which are formed in an axial direction. A bearing means, such as balls 243, each having a diameter which is larger than the thickness of sliding ring 242, are retained in pockets 34. Balls 243 contact and roll on the surface of fixed ring 241 and circular end plate 231. Therefore, the axial thrust load from orbiting scroll 23 is supported on fixed ring 241 through balls 243.

Referring to Figures 4 and 8, the construction of the center portion of the spiral element will now be described. Each spiral element 222 and 232 has a bulbous shaped enlarged portion 222a and 232a at its inner end portion. Each enlarged portion 222a and 232a is suitably curved for securing the line contacts and moving the line contacts along the curved surface without interfering with the relative movement of the spiral elements. Both enlarged portions 222a and 232a have the same configuration in order to form a pair of symmetrically sealed off fluid pockets. If the enlarged portions did not have the same configuration, the pair of sealed off fluid pockets would not be symmetrical and, accordingly, a pressure difference would exist between the pair of fluid pockets which would cause an improper torque and vibration of the compressor.

Valve chamber 35, which operates as the discharge chamber, is formed on the center of enlarged portion 222a of fixed scroll 22. In the embodiment shown in Figure 4, one end of valve chamber 35 facing end plate 231 of orbiting scroll 23 is closed and the other end of valve chamber 35 is open to discharge chamber 26. Discharge hole 36 is formed through the inner side wall of enlarged portion 222a of fixed scroll 22 at a position near the center of the generating circle of spiral element 222 to interconnect the central pocket of the spiral elements and valve chamber 35, and thereby reduce the pressure loss of passing fluid. Thus, the central pocket is connected to discharge chamber 26 through discharge hole 36 and valve chamber 35.

Valve member 37, which includes an annular shaped valve plate 371 (a check valve) and a valve retainer 372, is disposed within valve chamber 35.

Valve plate 371 includes reed valve 371a which is formed of spring metal so that valve plate 371 is usually pushed against the inner surface of valve chamber 35 by the spring force of valve plate 371. Therefore, the opening and closing of discharge hole 36 is controlled by reed valve 371a of valve plate 371. Valve retainer 372 is located within the inner side of valve plate 371 to prevent the extreme bending of reed valve 371a as shown in Figure 8. The axial movement of valve member 37 is prevented by stopper plate 38 which is fixed on the end surface of end plate 221 by screw 39 on the opposite side from which spiral element 222 extends.

As described above, orbiting scroll 23 is connected to the driving mechanism and rotation preventing/thrust bearing device 24 to effect the orbital motion of orbiting scroll 23 at a circular radius Ro upon rotation of drive shaft 13. Thus, when orbiting scroll 23 undergoes orbital motion at radius Ro upon rotation of drive shaft 13, the fluid or refrigerant gas introduced into suction chamber 27 from an external fluid circuit through an inlet port 40 on cup shaped casing 12 is taken into the fluid pockets formed between the spiral elements. As orbiting scroll 23 orbits; fluid in the fluid pockets is moved to the center of the spiral elements with a consequent reduction of volume. Compressed fluid is discharged into discharge chamber 26 from the central pocket through discharge hole 36 and valve chamber 35, and therefrom through outlet port 41 on cup shaped casing 12 to an external fluid circuit.

Referring to Figures 7a—7d, the discharge of compressed fluid now will be described. The spiral elements 222 and 232 interfit at an angular and radial offset to make a plurality of line contacts so that a pair of fluid pockets 3a and 3b are defined by the outer radial portions of the spiral elements and a central fluid pocket 5 is defined at the center of the spiral elements. As orbiting scroll 23 orbits, the pair of fluid pockets 3a and 3b shift angularly and radially toward the center of interfitting spiral elements 222 and 232 with the volume of each fluid pocket being gradually reduced as shown in Figures 7a—7d. The pair of fluid pockets 3a and 3b are connected to one another when the spiral elements pass stages shown in Figure 7b and Figure 7c, i.e., when the line contact between the inner side wall of enlarged portion 222a of fixed scroll 22 and the inner side wall of enlarged portion 232a of orbiting scroll 23 crosses over the edge of discharge hole 36, the pair of fluid pockets 3a and 3b are connected to one another through discharge hole 36. As shown in Figure 7d, both pockets 3a and 3b are completely connected to one another to form a single central pocket 5. The volume of the new single pocket 5 is further reduced by further revolution of 90° as shown in Figures 7a, 7b and 7c and, the pressure in central pocket 5 is increased. When the pressure in central pocket 5 is higher than the pressure in valve chamber 35, i.e., the pressure in discharge chamber 26, reed valve 371a is pushed against valve retainer 372 to open discharge hole 36. The compressed fluid in central pocket 5 is discharged into discharge chamber 26 through discharge hole 36 and valve chamber 35.

During the discharge stage, central pocket 5 is connected to the radial adjacent fluid pockets as shown in Figure 7c. Since, in this stage, the volume of the new central pocket which is connected to the pair of fluid pockets is enlarged, the remaining compressed fluid in the central pocket is re-expanded within the new central pocket. Therefore, the pressure in central pocket 5 decreases and the volume of the pair of fluid pockets which are connected to the central pocket increases. Accordingly, the pressure in the new central pocket is lower than the pressure in valve chamber 35. Thus, reed valve 371a is pushed against the inner surface of valve chamber 35 due to the pressure difference and the opening of discharge hole 36 is closed by reed valve 371a. Then, another compression stage begins.

Figures 9 and 10 show another embodiment in which the construction of the valve chamber of the enlarged portion of the fixed spiral element is modified. The end of valve chamber 35 facing end plate 231 of orbiting scroll 23 is opened and the other end of valve chamber 35 is closed by end plate 221 of fixed scroll 22. A connecting hole 42, which is connected between valve chamber 35 and discharge chamber 26, is formed through end plate 221. Thus, central pocket 5 is connected to discharge chamber 26 through discharge hole 36, valve chamber 35 and connecting hole 42. Valve member 37 is located between the end surface of end plate 221; snap ring 43 disposed on the inner surface of valve chamber 35 prevents axial movement of valve member 37.

Claims

1. A scroll type compressor including a housing (10) having a fluid inlet port (40) and a fluid outlet port (41), a fixed scroll (22) joined with said housing (10) and having a first end plate (221) from which a first wrap (222) extends into the interior of said housing (10), an orbiting scroll (23) having a second end plate (231) from which a second wrap (232) extends, said first and second wraps (222, 232) interfitting at an angular and radial offset to make a plurality of line contacts to define at least one pair of sealed off fluid pockets and a central fluid pocket, a driving mechanism (13-132-31-32) operatively connected to said orbiting scroll (23) to effect the orbital motion of said orbiting scroll (23), and a rotation preventing means (24) for preventing the rotation of said orbiting scroll (23) so that the volume of the fluid pockets changes during the orbital motion of said orbiting scroll (23), characterised in that the inner end portion of each of said wraps (222, 232) has a bulbous shaped enlarged portion (222a, 232a), a valve chamber (35) is formed in the enlarged portion (222a) of said first wrap (222), a discharge hole (36) is formed through the inner side wall of said enlarged portion (222a) at a position near the

center of the generating circle of said orbiting scroll (23) to connect the central fluid pocket and said valve chamber (35), a valve member (37) is disposed within said valve chamber (35) to control the opening and closing of said discharge hole (36), and said valve member (37) includes an annular shaped valve plate (371) which has a reed valve (371a) and a valve retainer (372) disposed within the inner side of said valve plate (371).

2. A scroll type compressor as claimed in claim 1, wherein said fixed scroll (22) is fixed within the interior of said housing (10) and said first end plate (221) partitions the interior of said housing (10) into a discharge chamber (26) and a suction chamber (27), said valve chamber (35) being connected to said discharge chamber (26).

3. A scroll type compressor as claimed in claim 1, wherein an axial end of said valve chamber (35) facing said second end plate (231) is closed and the other axial end is opened on said first end plate (221), said valve member (37) being disposed between the inner axial end surface of said valve chamber (35) and a stopper plate (38) fixed on the end surface of said first end plate (221) to limit the axial movement of said valve plate (371).

4. A scroll type compressor as claimed in claim 1, wherein the axial end of said valve chamber (35) facing said second end plate (231) is opened and the other axial end is closed by said first end plate (221), said scroll type compressor further comprising a connecting hole (42) formed through said first end plate (221) for connecting said valve chamber (35) and said discharge chamber (26), said valve member (37) being disposed between the end surface of said first end plate (221) and a snap ring (43) disposed on the inner surface of said valve chamber (35) to limit the axial movement of said valve member (37).

5. A scroll type compressor as claimed in claim 1, wherein said discharge hole (36) has a circular shape.

6. A scroll type compressor as claimed in claim 1, wherein said discharge hole (36) has an oval shape.

Revendications

1. Compresseur de type à volutes comprenant un carter (10) muni d'un orifice d'entrée de fluide (40) et d'un orifice de sortie de fluide (41), une volute fixe (22) reliée au carter (10) et comportant une première plaque d'extrémité (221) d'où part un premier enroulement (222) pénétrant à l'intérieur du carter (10), une volute orbitale (23) munie d'une seconde plaque d'extrémité (231) d'où part un second enroulement (232), ces premier et second enroulements (222, 232) s'emboîtent avec un décalage angulaire et radial pour former un certain nombre de lignes de contact définissant au moins une paire de poches à fluide étanches et une poche à fluide centrale, un mécanisme d'entraînement (13-132-31-32) relié en fonctionnement à la volute orbitale (23) pour produire le mouvement orbital de cette volute orbitale (23), et des moyens anti-rotation (24) permettant d'empêcher la rotation de la volute orbitale (23) de façon que le volume des poches à fluide change pendant le mouvement orbital de la volute orbitale (23), compresseur caractérisé en ce que la partie d'extrémité intérieure de chacun des enroulements (222, 232) comporte une partie agrandie en forme de bulbe (222a, 232a), en ce qu'une chambre de soupape (35) est formée dans la partie agrandie (222a) du premier enroulement (222), en ce qu'un trou de refoulement (36) est percé dans la paroi latérale intérieure de la partie agrandie (222a) dans une position voisine du centre du cercle générateur de la volute orbitale (23), de manière à relier la poche à fluide centrale à la chambre de soupape (35), en ce qu'un élément de soupape (37) est placé dans la chambre de soupape (35) pour commander l'ouverture et la fermeture du trou de refoulement (36), et en ce que l'élément de soupape (37) comprend une plaque de soupape de forme annulaire (371) muni d'une soupape à anche (371a) et d'un élément de retenue de soupape (372) placé du côté intérieur de la plaque de soupape (371).

2. Compresseur de type à volutes selon la revendication 1, caractérisé en ce que la volute fixe (22) est fixée à l'intérieur du carter (10) et en ce que la première plaque d'extrémité (221) sépare l'intérieur du carter (10) en une chambre de refoulement (26) et une chambre d'aspiration (27), la chambre de soupape (35) étant reliée à la chambre de refoulement (26).

3. Compresseur de type à volutes selon la revendication 1, caractérisé en ce que l'extrémité axiale de la chambre de soupape (35) venant en face de la seconde plaque d'extrémité (231), est fermée, et en ce que l'autre extrémité axiale est ouverte sur la première plaque d'extrémité (221), l'élément de soupape (37) étant disposé entre la surface d'extrémité axiale intérieure de la chambre de soupape (35) et une plaque de butée (38) fixée sur la surface d'extrémité de la première plaque d'extrémité (221) pour limiter le mouvement axial de la plaque de soupape (371).

4. Compresseur de type à volutes selon la revendication 1, caractérisé en ce que l'extrémité axiale de la chambre de soupape (35) venant en face de la seconde plaque d'extrémité (231) est ouverte, et en ce que l'autre extrémité axiale est fermée par la première plaque d'extrémité (221), le compresseur de type à volutes comprenant en outre un trou de liaison (42) percé dans la première plaque d'extrémité (221) pour relier la chambre de soupape (35) à la chambre de refoulement (26), l'élément de soupape (37) étant monté entre la surface d'extrémité de la première plaque d'extrémité (221) et un anneau de blocage (43) placé sur la surface intérieure de la chambre de soupape (35) pour limiter le mouvement axial de l'élément de soupape (37).

5. Compresseur de type à volutes selon la revendication 1, caractérisé en ce que le trou de refoulement (36) présente une forme circulaire.

6. Compresseur de type à volutes selon la revendication 1, caractérisé en ce que le trou de refoulement (36) présente une forme ovale.

Patentansprüche

1. Kompressor von Spiraltyp einschließlich eines Gehäuses (10) mit einer Flüssigkeitseinlaßöffnung (40) und einer Flüssigkeitsauslaßöffnung (41), einer mit dem besagten Gehäuse (10) verbundenen und eine erste Endplatte (221), von der sich ein erstes Spiralelement (222) in das Innere von dem besagten Gehäuse (10) erstreckt, aufweisenden festen Spirale (22), einer eine zweite Endplatte (231), von der sich ein zweites Spiralelement (232) erstreckt, aufweisenden umlaufenden Spirale (23), wobei das besagte erste und zweite Spiralelement (222, 232) mit einer winkelmäßigen und radialen Versetzung ineinandergreifen und damit eine Mehrzahl von Linienkontakten zur Begrenzung zumindest eines Paares dicht abgeschlossener Flüssigkeitstaschen und einer zentralen Flüssigkeitstasche bilden, einer wirksam mit der besagten umlaufenden Spirale (23) verbundenen, die umlaufende Bewegung der besagten umlaufenden Spirale (23) zu bewirkenden Antriebsvorrichtung (13, 132, 31, 32) und einer eine Drehung verhindernden Einrichtung (24) zum Verhindern der Drehung der besagten umlaufenden Spirale (23) so, daß sich das Volumen der Flüssigkeitstaschen während des Umlaufes der besagten Spirale (23) verändert, dadurch gekennzeichnet, daß das innere Endstück von jedem der besagten Spiralelemente (222, 232) einen kugelförmigen vergrößerten Teil (222a, 232a) hat, eine Ventilkammer (35) in dem vergrößerten Teil (222a) von dem besagten ersten Spiralelement (222) gebildet ist, eine Entleerungsöffnung (36) durch die innere Seitenwand des besagten vergrößerten Teiles (222a) an einer Stelle nahe des Mittelpunktes des erzeugenden Kreises der besagten umlaufenden Spirale (23) zum Verbinden der zentralen Flüssigkeitstasche und des besagten Ventilgehäuses (35) gebildet ist, ein Ventilelement (37) zur Steuerung des Öffnens und Schließens der besagten Entleerungsoffnung (36) in der besagten Ventilkammer (35) angebracht ist und das besagte Ventilelement (37) eine ringförmige Ventilplatte (371) aufweist, die ein Plättchenventil bzw. Schieberventil (371a) und einen auf der Innenseite der besagten Ventilplatte (371) angebrachten Ventilanschlag (372) hat.

2. Kompressor vom Spiraltyp nach Anspruch 1, in dem die besagte feste Spirale (22) im Inneren von dem besagten Gehäuse (10) befestigt ist und die besagte erste Endplatte (221) das Innere von dem besagten Gehäuse (10) in eine Auslaßkammer (26) und eine Ansaugkammer (27) unterteilt, wobei die besagte Ventilkammer (35) mit der besagten Auslaßkammer (26) verbunden ist.

3. Kompressor vom Spiraltyp nach Anspruch 1, in dem ein der besagten zweiten Endplatte (231) zugewandtes axiales Ende der besagten Ventilkammer (35) verschlossen ist und das andere axiale Ende zu der besagten ersten Endplatte (221) hin geöffnet ist, wobei das besagte Ventilelement (37) zwischen der inneren axialen Endfläche von der besagten Ventilkammer (35) und einer Anschlagplatte (38), die auf der Endoberfläche der besagten ersten Endplatte (221) zur Begrenzung der axialen Bewegung der besagten Ventilplatte (371) befestigt ist, angebracht ist.

4. Kompressor vom Spiraltyp nach Anspruch 1, in dem das der besagten zweiten Endplatte (231) zugewandte axiale Ende von der besagten Ventilkammer (35) offen ist und das andere axiale Ende durch die besagte erste Endplatte (221) verschlossen ist, wobei der besagte Kompressor vom Spiraltyp weiter ein in der besagten ersten Endplatte (221) ausgebildetes Verbindungsloch (42) zum Verbinden der besagten Ventikammer (35) und der besagten Auslaßkammer (26) aufweist, wobei das besagte Ventilelement (37) zwischen der Endoberfläche von der besagten ersten Endplatte (221) und einem auf der Innenoberfläche von der besagten Ventilkammer (35) zur Begrenzung der axialen Bewegung des besagten Ventilelementes (37) angebrachten Sprengring (43) angebracht ist.

5. Kompressor vom Spiraltyp nach Anspruch 1, in dem die besagte Entleerungsöffnung (36) eine kreisförmige Form hat.

6. Kompressor vom Spiraltyp nach Anspruch 1, in dem die besagte Entleerungsöffnung (36) eine ovale Form hat.

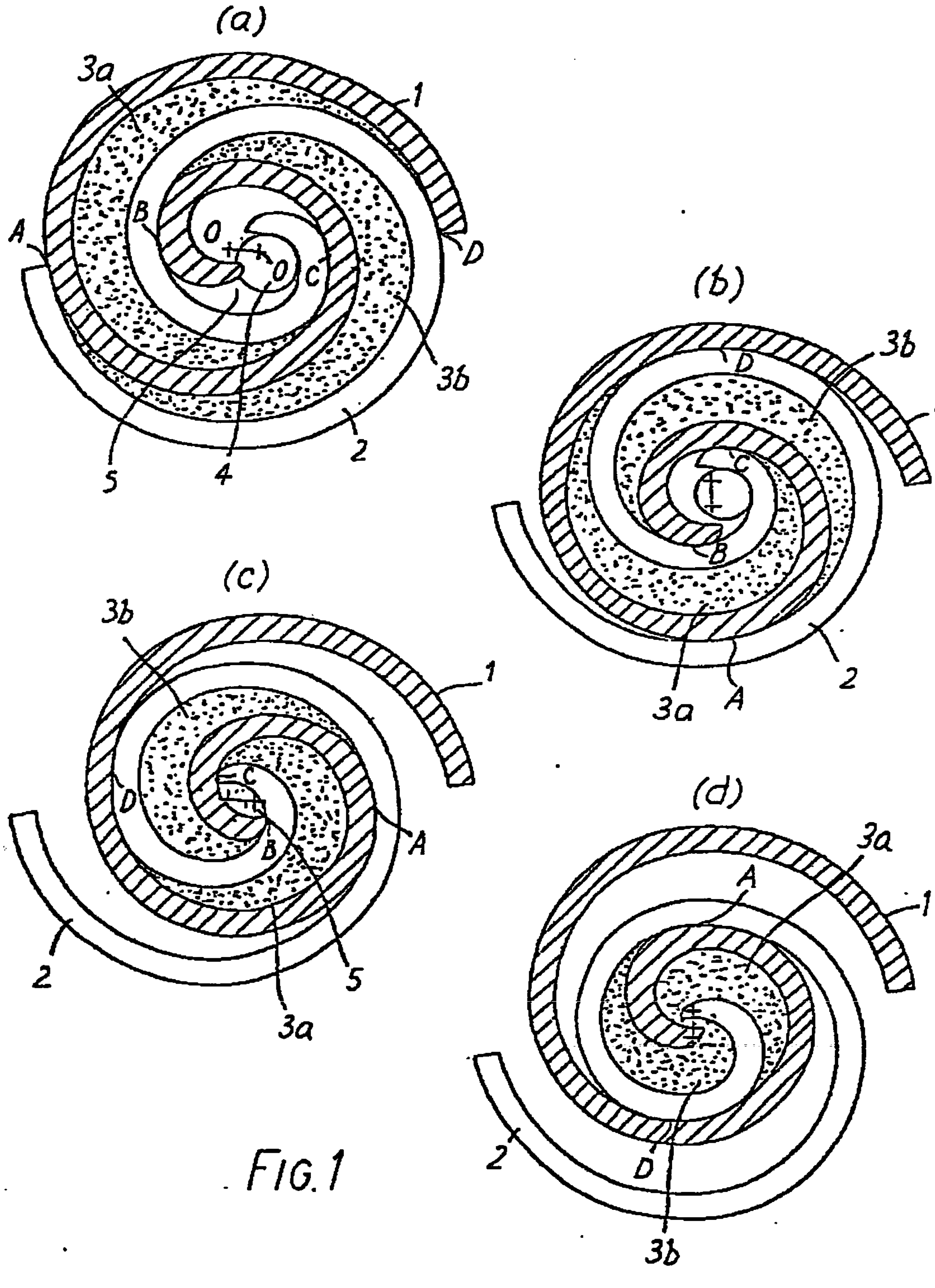


FIG.1

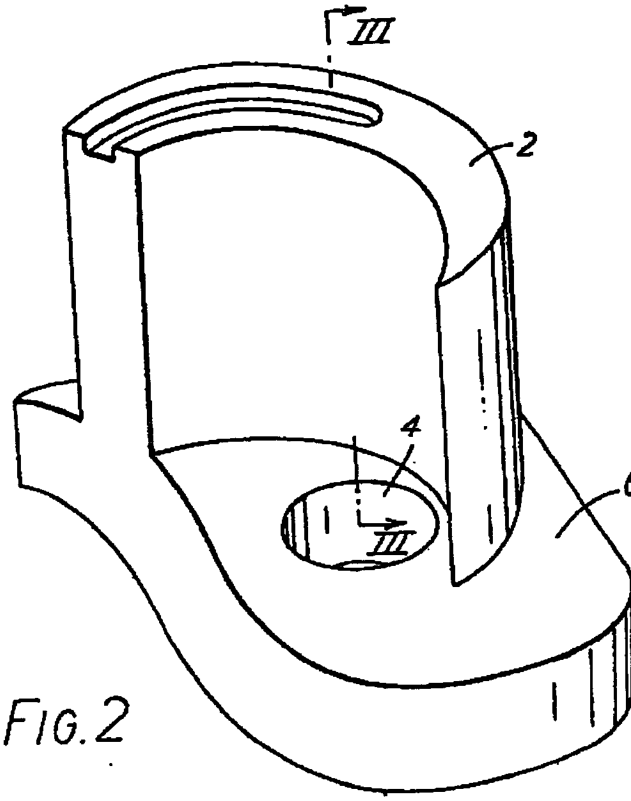


FIG.2

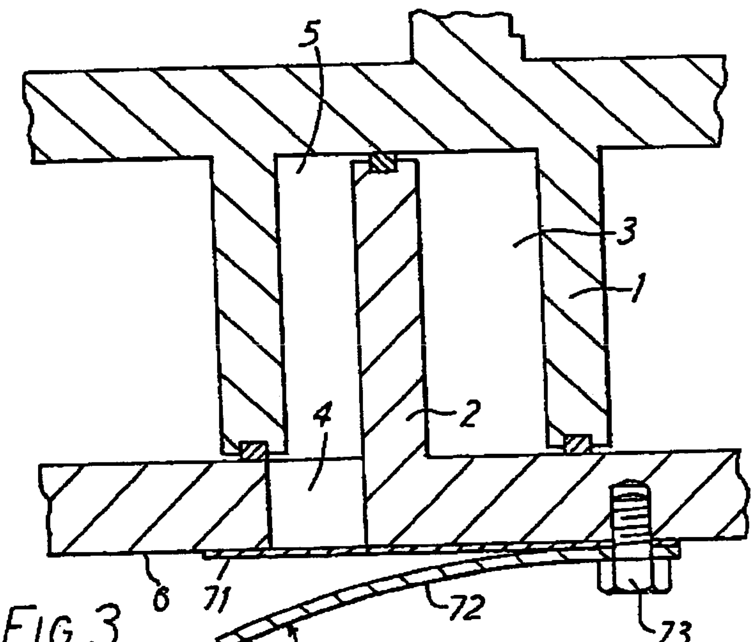


FIG.3

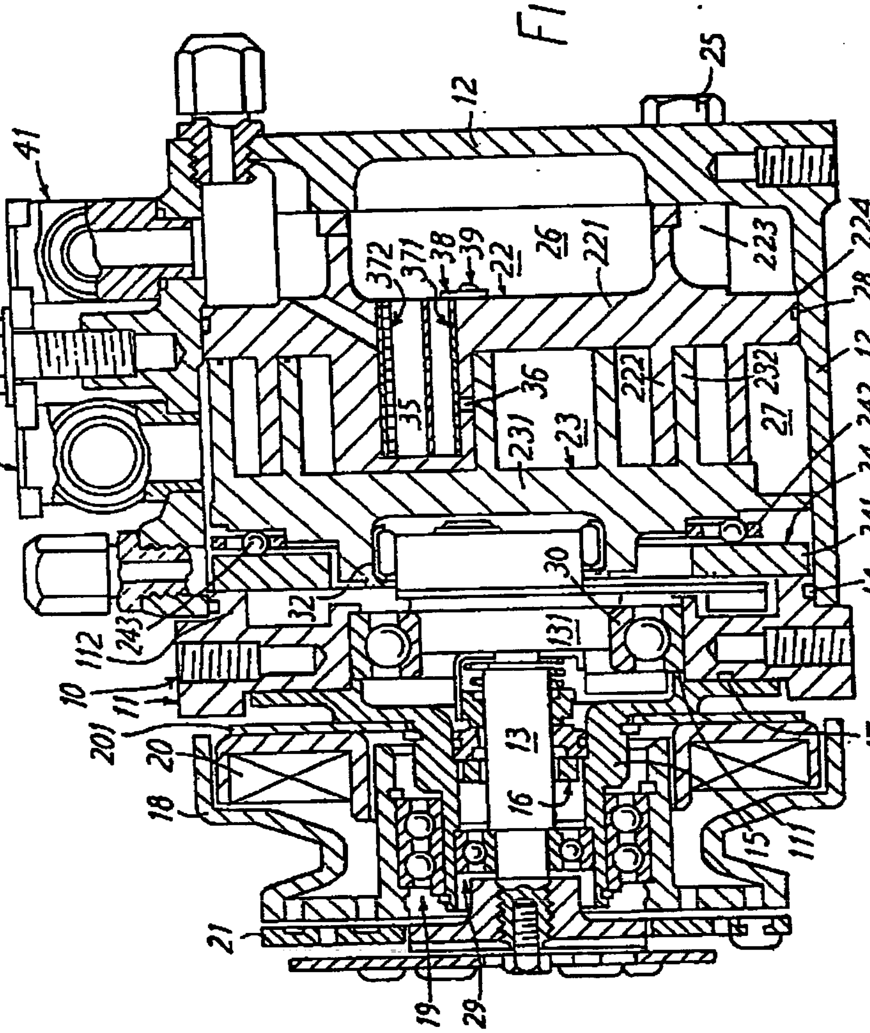

41
12
25
40
372
371
38
39
22
26
221
223
224
28
12
35
36
231
23
222
232
27
242
24
241
14
30
32
243
112
10
11
131
201
20
13
16
18
17
15
111
21
19
29

FIG. 4

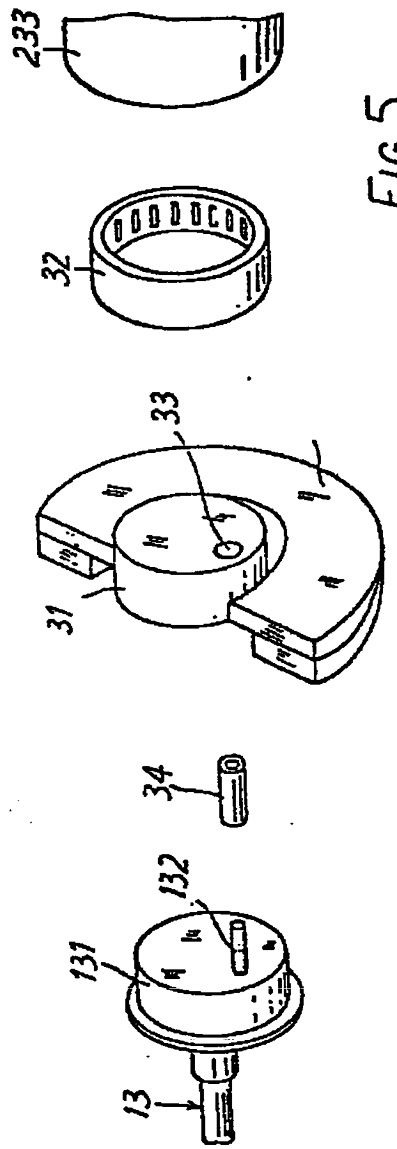

233
32
33
31
34
132
131
13

FIG.5

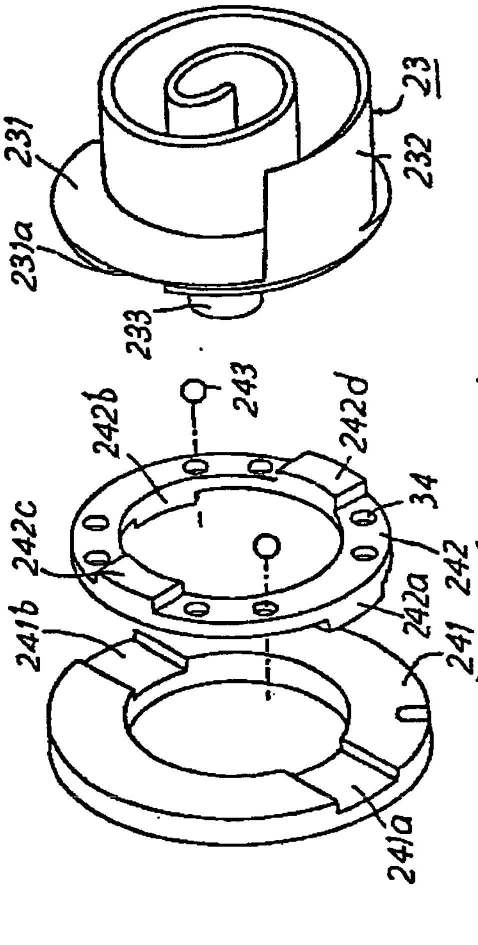

231
231a
233
232
23
243
242b
242d
242c
34
242
242a
241b
241
24
241a

FIG.6

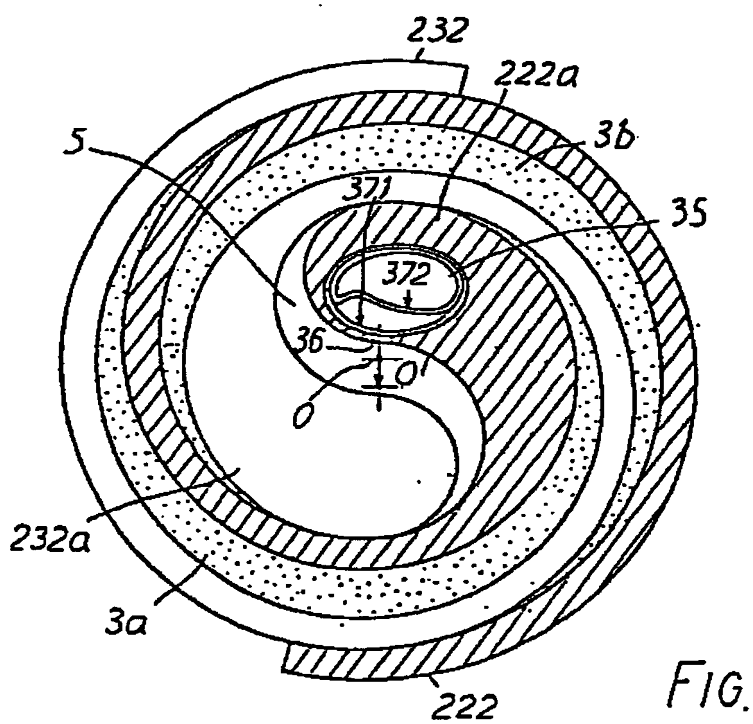

232
222a
5
3b
371
35
372
36
O'
O
232a
3a
222

FIG. 7a

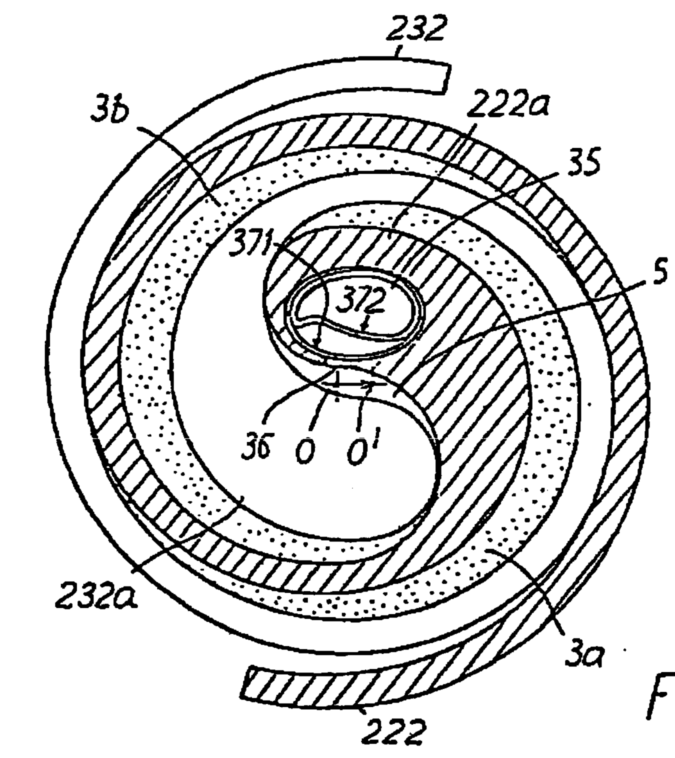

232
3b
222a
35
371
372
5
36
O
O'
232a
3a
222

FIG 7b

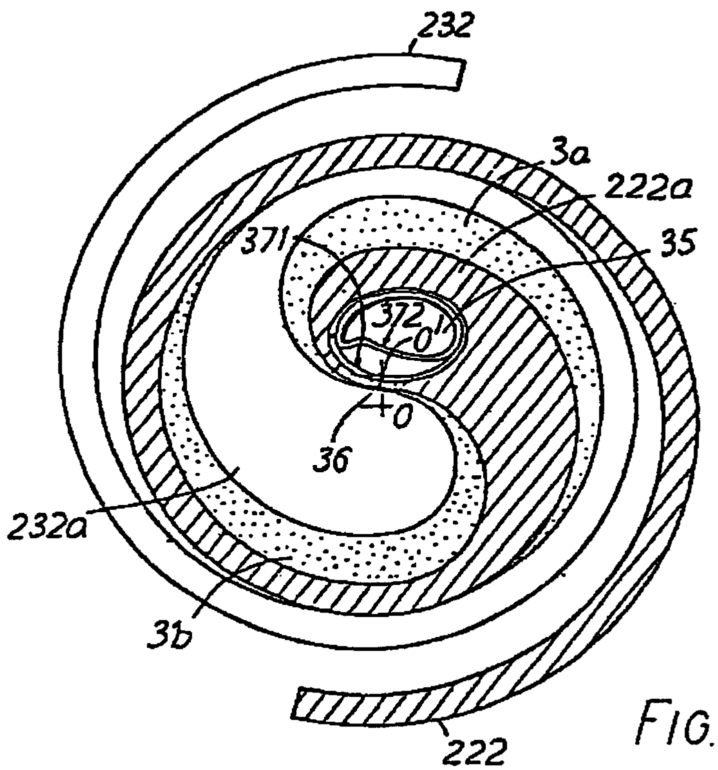

232
3a
222a
371
35
372
O'
O
36
232a
3b
222

FIG.7c

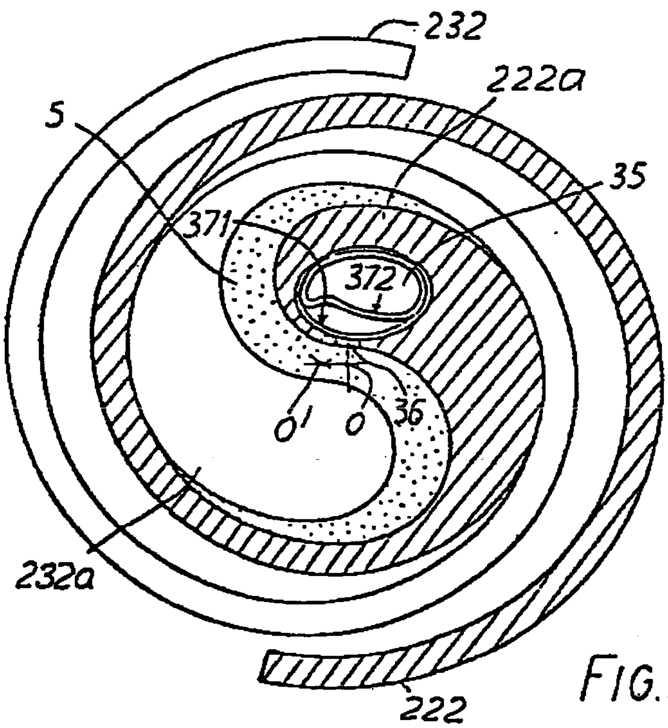

232
222a
5
35
371
372
O'
O
36
232a
222

FIG.7d

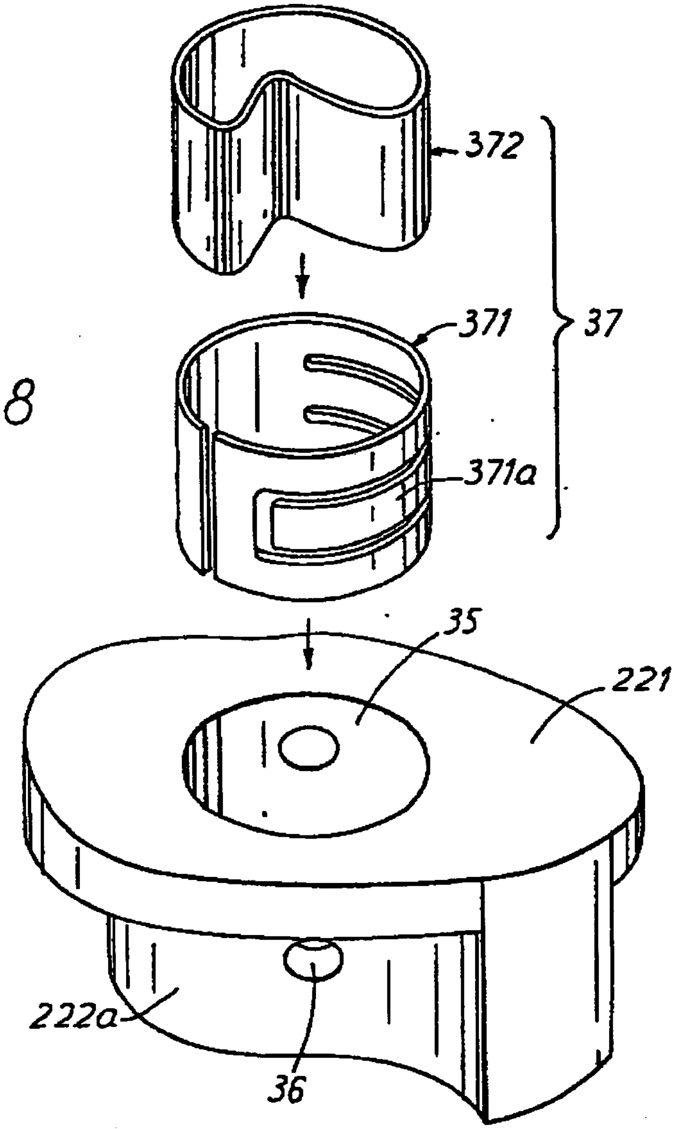
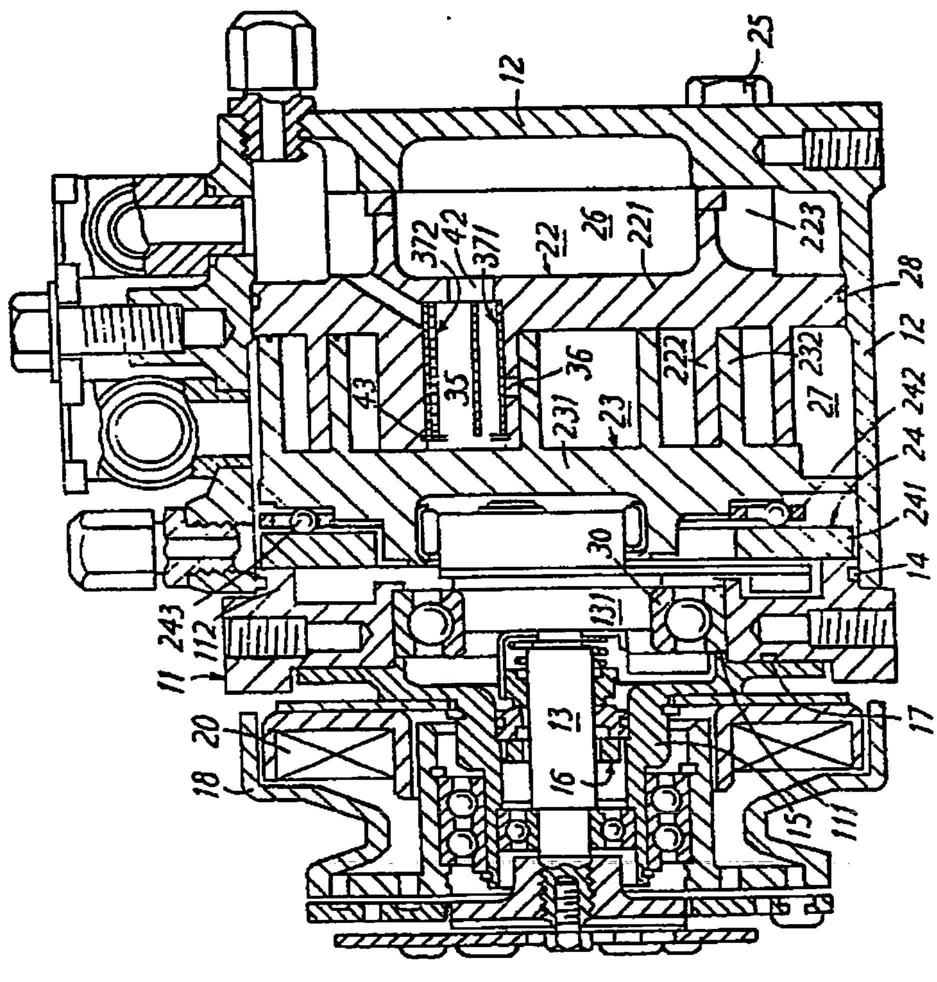


FIG.8

FIG.9


12
25
372
42
371
22
26
221
223
28
12
232
222
36
35
43
231
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27
242
24
241
30
14
131
243
112
11
20
18
13
16
17
15
111

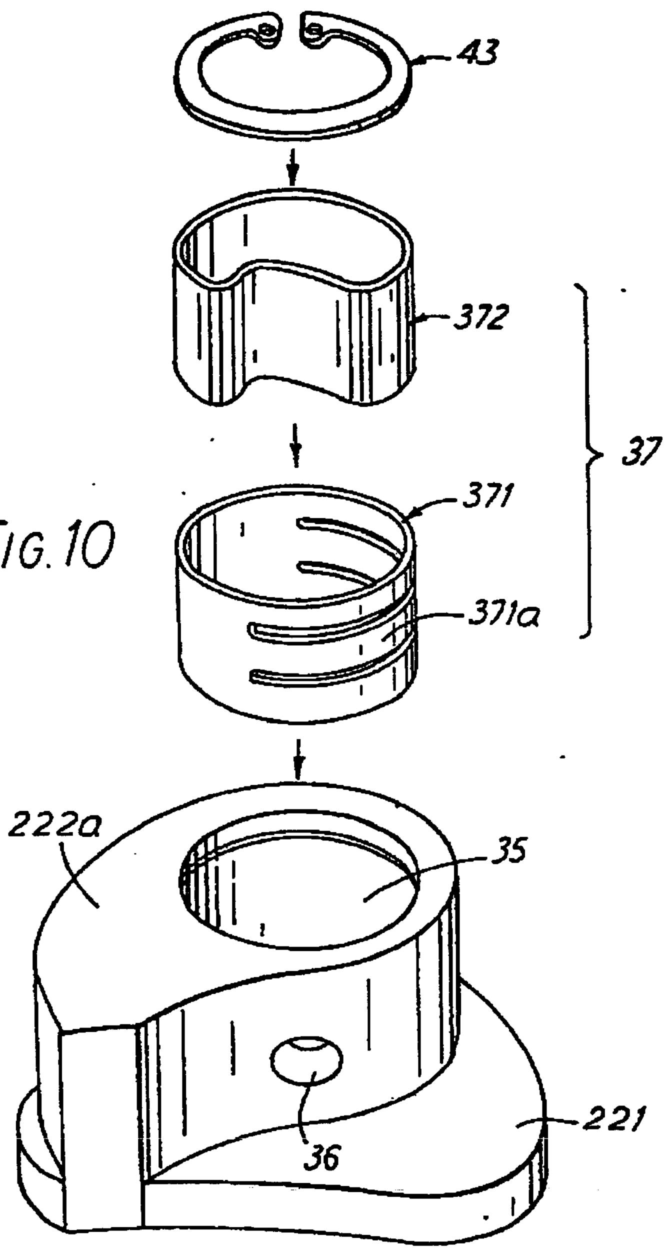

FIG.10